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EFFICACY OF LIGHTNING RODS.

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FIRE LOSSES.

It is stated on good authority that in the United States fire costs over $500 a minute. The National Fire Prevention Association of New York states that fire losses and the cost of fire protection amounts to $450,000,000 in the United States each year. This is $850 a minute.

Fire Losses Due to Lightning.—The Wisconsin Fire Marshal says that lightning in this country destroys more property than matches, sparks, and kerosene together, and more than any other cause, except defective flues.

Figures gathered from the reports of the State Fire Marshals in Iowa, Indiana, and Ohio, for 1913, indicate that the number of fires due to lightning was one-sixth of the number from all causes and the loss by lightning one-eleventh of the total fire loss.

In the summer of 1914, the writer gathered statistics from 121 Mutual Fire Insurance Companies operating in 15 different States, largely in the central part of the country. These statistics show that in 1913 the total number of buildings burned from any cause was 1,174. During the same year 809 buildings were struck by lightning and damaged and 252 struck by lightning and burned. This indicates nearly as many buildings struck by lightning as were burned from any cause, but that the number burned

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by lightning was less than one-fourth of the total lost by fire. The loss on the buildings burned or damaged by lightning was about one-third of the total fire loss.

Loss by Lightning Largely in Rural Districts.—In the central part of the country the loss and damage by lightning is far greater in the country than in the cities. The Indiana Fire Marshal states that 75% of all lightning losses occur in the country, which contains but 47% of the population. Also that in 1913, 92% of all barns damaged by lightning were in the country and that 69% of all barn losses were total. The Ohio Fire Marshal says that of 416 lightning fires in 1913, 319 were in barns. One insurance agent in Missouri reports that in 17 years the losess due to lightning on barns has been $6,000 greater than by fire from other causes.

Lightning.—Lightning is an electric spark on a tremendous scale. It occurs between clouds more frequently than between cloud and earth. Flashes last from one-one-hundred-thousandth to one-five-thousandth of a second.

Damage by lightning is mechanical as well as thermal. Not only is damage done by main discharges, but currents are induced in near-by metal objects and conductors and these often produce additional damage. Fires may be started in inflammable material between two nearly parallel rods or wires by these induction effects. Cases cited are between a fan shaft and a drive shaft bearing in a flour mill. Also between wires on baled hay, and between telephone wires and a lightning rod, where it is stated that lightning will jump 10 to 15 feet between the lightning rod and telephone wire.

Lightning Rods.—There was a time when lightning rods were a fad and the lightning rod agent flourished in the land and waxed fat. Because the lightning rod agent insisted on accumulating the good things of the land too rapidly there soon came a second period when shot guns were kept loaded and within reach, because the lightning rod agent was more to be feared than the lightning. And this second period still obtains in some parts of this country today.

But the lightning rods that were up staid up and those that had been installed in an honest and correct manner apparently furnished protection, while all around them buildings were being destroyed by lightning strokes.

Fire protection agencies, appalled at the immense fire loss, have in more recent years turned to the lightning rod as a possible aid. Honest lightning rod manufacturing companies have insisted that properly erected lightning rods are a protection, and professors of physics have told us that lightning rods, when continuous from the moist earth to the top of buildings, must aid

materially in the quiet interchange of electricity that is constantly taking place between the atmosphere and the earth, and that the rods should lead a disruptive discharge safely to the earth.

As a result, lightning rods are being put up, especially on barns in the country districts and Mutual Fire Insurance Companies are raising the question as to their efficacy.

To aid in answering this question the writer was directed by the Chief of the U. S. Weather Bureau to collect information for the Annual Meeting of the National Association of Mutual Fire Insurance Companies held in Columbus, in September, 1914.

Letters were therefore sent out to Mutual Companies in nearly every state in the Union, particularly those in rural districts. A large number of replies have been received and these have been summarized in the attached table.

This table shows that in 1912 and 1913 about 200 mutual companies doing a business of fully $300,000,000, had 1,845 buildings struck by lightning. And of the number struck by lightning, 67 only were equipped with lightning rods.

Do Lightning Rods Prevent Lightning Strokes?—The best information obtainable indicates that 31% of the buildings insured by these companies were equipped with lightning rods. This being the case, the expectation would be that of the 1,845 struck by lightning, 31% or 572 would be rodded, but in fact only 67 had rods of any kind. The number struck is therefore only 10% of the expected number, and the efficiency of the lightning rod in actually preventing lightning strokes is shown to be 90%.

In a report covering the past 5 years, 51 different companies having nearly 95,000 buildings insured, had 660 buildings struck by lightning and only 21 of these had lightning rods. Fully 34% of their buildings are rodded, so the expectation would be that 34% of 660, or 224 would be rodded. In fact only 21, or 9% were rodded, showing that out of every 100 buildings struck by lightning, 91 of them were without lightning rods and only 9 had rods.

A table made up from 67 different companies in Missouri, Illinois and Ohio, showed practically the same efficacy. Five companies doing business in Illinois, Missouri, and Nebraska with over 18,000 buildings insured, with reports covering a longer period of years, the shortest being 13 years and the longest 25 years, never have had a building burned or even materially damaged by lightning that was equipped with a lightning rod. And they report over 50% of their buildings rodded. This is efficiency of 100%.

If we should omit the few companies who have had damage on rodded buildings, we would still have reports from over 100 Farm Mutual Insurance Companies with over 400,000 buildings

insured and with a total risk of not far from $300,000,000, most of them reporting for the years 1912 and 1913, quite a number covering the past 5 years, and 5 for between 13 and 25 years, with not one building ever burned or damaged to any extent by lightning that had a lightning rod on it.

These findings of the efficacy of the lightning rod in preventing lightning stroke are contrary to the general opinion, but they substatiate those by Professor W. H. Day, of the Ontario Agricultural College, as published in their Bulletin 220. His inquiry covered Ontario, Iowa and Michigan, and included the records for several years and found the efficacy of a lightning rod in preventing lightning stroke to be from 92% to 99.9%.

Damage to Rodded Buildings.—In addition to actually preventing the lightning stroke, the properly installed lightning rod is of very great value in preventing damage to a building when it is struck by lightning.

The table in this report shows that the total claims paid on farm buildings due to lightning in 1912 and 1913, was $336,171. Inasmuch as 31% of the buildings insured by these companies were rodded, we would expect a loss on rodded buildings of 31% of $336,171, or $104,213, but as a matter of fact the total claims paid by these companies by lightning damage on rodded buildings during the two years was only $12,788. In other words the actual loss was only 12% of what would have occurred if the lightning rods did not serve as a protection.

The total number of buildings burned by lightning in 1912 and 1913 as reported by these companies was 407, and of these only 9 were equipped with lightning rods, or only 2%. Of those struck that had rods only 5% were burned and the other 95% simply damaged. Showing that the danger of a building being burned by lightning that is equipped with lightning rods is exceedingly slight.

A further study of the reports sent shows that where the buildings were struck by lightning and damaged, but not burned down the average damage per building was less than $10 on those equipped with lightning rods and very nearly $200 per building where not equipped with lightning rods.

Imperfect Rodding.—In some of the cases where rodded buildings were burned or damaged by lightning, the rods were recently installed and appeared to be in good condition. But in a large number of cases the rods were known to have been in poor condition or improperly installed. Some of the rods were old and defective, some not properly grounded, in some cases the lightning entered the building on a clothesline, in others the lightning struck a nearby building and the fire was communicated to the rodded one.

The all important thing seems to be to have a **continuous** conductor from the highest points on the building to permanently moist earth beneath. The kind of material does not seem to be so important as to be sure of frequent inspection, good grounds, and constant care that there are no poor or broken joints, or rusted and broken sections. The general opinion seems to be that the rods should be fastened directly to the side of the buildings without insulators and that all heavy masses of metal like hay tracks, etc., should be fastened to the lightning rods.

The Installation of Lightning Rods.—While lightning rods should be carefully installed yet their erection involves no more wonderful or mysterious process than building a fence or digging a well.

The statement by some lightning rod agents that no one but a special scientist versed in all the laws of electricity should do the work of putting up lightning conductors, is about as sensible as to say that no one but a professor in geometry should be allowed to lay brick.

And not only that, but any professional in the lightning rod business who advocates that his system is the only one that is scientifically correct and reliable, while all others are worthless and dangerous, invites the suspicion that he is himself a faker and charlatan.

Iron rods have some advantages over copper, but iron should be used only where it will be frequently inspected and kept painted. A 3-8 inch seven-strand, double galvanized iron cable is recommended and may be put up by the owner himself. Copper conductors should be soft drawn in the form of either tape or stranded cable. The National Board of Fire Underwriters for Protection Against Lightning make definite recommendations as to kind and form of rods.

Summary of answers from Mutual Fire Insurance Companies, received by J. Warren Smith, in August and September, 1914. A copy of the letter is attached. The columns are numbered to agree with the questions:

ITEMS	*	1	2	3	4	5	6	7	8	†
For 1912.....	92	191,009	469	756	588	154	24	14	3	31
For 1913.....	121	328,565	1,174	1,089	809	252	43	33	6	31
For 5 years.....	51	94,797	465	660	456	155	21	11	1	34
Misc. ‡	‡	18,155	591	495	245	71	0	0	0	55

ITEMS	9	10	11	12
For 1912.....	$173,343,000	$362,009	$137,590	$8,104
For 1913.....	249,883,000	572,344	198,581	4,949
For 5 years.....	63,026,000	185,963	71,442	270
Misc. ‡.....	6,771,000	159,920	48,252	0

*Total number of insurance companies reporting.

† Percentage of buildings rodded.

‡ Summary from 5 different companies covering a term of years, the shortest being 13 and the longest 25 years.

August 3, 1914.

CIRCULAR LETTER.

DEAR SIR:—This letter is being sent to a large number of Mutual Fire Insurance Companies in the United States with the hope of being able to compile valuable statistics as to the efficacy of lightning rods on farm buildings.

The answer will be considered confidential and the only matter published will be averages from a large number of reports. The information collected is to be used in the preparation of a paper to be read at the September meeting of the National Association of Mutual Insurance Companies in this city. Therefore please give the questions early and careful attention and make the answers just as complete as possible, even at the expense of some labor. Very respectfully,

J. WARREN SMITH,
Professor in Meteorology.

QUESTIONS	In Year 1913	In Year 1912	Average in 5 years
1. Total number of farm buildings insured by your company	.....	.....	.....
2. Total number of farm buildings burned from any cause	.....	.....	.....
3. Total buildings struck by lightning	.....	.....	.....
4. Total struck, only damaged	.....	.....	.....
5. Total struck that were burned	.....	.....	.....
6. Of those struck by lightning how many had lightning rods	.....	.....	.....
7. Of those struck and damaged only, how many had rods?	.....	.....	.....
8. Of those burned by lightning how many had rods?	.....	.....	.....
9. Please give total risks on farm buildings.	.....	.....	.....
10. Give total claims paid from all fire loss on farm buildings.	.....	.....	.....
11. Give total claims paid due to lightning.	.....	.....	.....
12. Give total paid due to lightning on rodded buildings.	.....	.....	.....
13. Do you make any reduction in rate on rodded buildings?	.....	.....	.....

If you have had any cases where rodded buildings have been burned or damaged by lightning kindly give any information that you may have as to the kind of lightning rod, when put up and whether in good condition.

Name and address of Company.....

Date.....